UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/771,047	02/02/2004	Kalin Spariosu	PD-02W202	1523

7590 06/26/2006

John E. Gunther
Raytheon Company
P.O. Box 902 (E1/E150)
El Segundo, CA 90245-0902

EXAMINER	
LANE, JEFFREY D	

ART UNIT	PAPER NUMBER
2828	

DATE MAILED: 06/26/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/771,047	SPARIOSU ET AL.	
	Examiner	Art Unit	
	Jeffrey D. Lane	2828	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 March 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-57* is/are pending in the application.

4a) Of the above claim(s) *10 and 11* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9 and 12-57* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election of species 1 in the reply filed on 3/13/2006 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claim Objections

2. A series of singular dependent claims is permissible in which a dependent claim refers to a preceding claim which, in turn, refers to another preceding claim.

A claim which depends from a dependent claim should not be separated by any claim which does not also depend from said dependent claim. It should be kept in mind that a dependent claim may refer to any preceding independent claim. In general, applicant's sequence will not be changed. See MPEP § 608.01(n).

3. Claim 8 is objected to because of the following informalities: the limitation of "...by approximately more than 1.4 centimeters" is indefinite, for examination purposes it will be interpreted as "...by more than 1.4 centimeters" . Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 34 and 35 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As for claims 34 and 35 how can the resonator cores be equal lengths (claim 32) and different lengths (34 and 35) at the same time? Because, being equal lengths and different lengths are mutually exclusive, a proper examination of claims 34 and 35 are precluded.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 4, 8, and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Kubota et al. (US 5202893).

As for claim 1 Kubota discloses in fig. 1, A robust scalable laser system comprising: plural laser resonators 3 and a cavity external to said laser resonators (between 5 and 6), said cavity adapted to combine plural laser beams output from said plural laser resonators into a single output laser beam L3.

As for claims 4 Kubota discloses, high-power laser pump sources 1 coupled to said fiber laser resonators 3.

As for claim 8 Kubota discloses, fiber laser resonators are approximately equivalent lengths or differ in length by more than 1.4 centimeters. As shown the left most and right most fibers are approximately equal and therefore reads on the claim.

As for claim 12 Kubota discloses, the cavity incorporates a light pipe 7.

6. Claims 1, 2, 4, 7, and 13-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Komine (US 2005/0078714).

As for claim 1, Komine discloses in fig. 2A, A robust scalable laser system comprising: plural laser resonators 22 and a cavity external 28 to said laser resonators, said cavity adapted to combine plural laser beams output from said plural laser resonators into a single output laser beam.

As for claim 2, Komine discloses, said plural laser resonators are eye-safe fiber laser resonators. (See Title)

As for claim 4, Komine discloses, including high-power laser pump sources coupled to said fiber laser resonators (See title).

As for claim 5, Komine discloses, the pump sources are laser diodes (See Paragraph [0019])

As for claim 7, Komine discloses, pump sources are side coupled, edge coupled, fusion coupled, and/or coupled via a reflective cavity. (See Paragraph [0022]).

As for claim 13, Komine discloses in figure 2A, An eye-safe laser system comprising: plural fiber laser resonators 22 adapted to laser at eye-safe wavelengths and means for combining beams 28 output from said plural fiber laser resonators into a single eye-safe laser beam (See title).

As for claim 14, means for combining includes an external cavity 28.

As for claim 15, plural fiber laser resonators are coupled to plural pump sources 22.

7. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Telfair et al. (US 6090102).

As for claim 1, Telfair discloses in figure 5, A robust scalable laser system comprising: plural laser resonators 188 and a cavity external (173 to 175) to said laser resonators 188, said cavity adapted to combine plural laser beams output from said plural laser resonators into a single output laser beam 250.

8. Claim 29 is rejected under 35 U.S.C. 102(b) as being anticipated by Cloonan et al. (US 5258978).

As for claim 29, Cloonan discloses in fig. 85, A beam phase-locking system comprising: first means for receiving plural single-mode beams of electromagnetic energy and providing flat-top beams (See 45/59-61) as output in response thereto and second means for combining said flat-top beams via spatial filtering and providing a collimated combined beam in response thereto (45/61-68).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 2, 3, 13-15, 46, and 57 are rejected under 35 U.S.C. 103(a) as obvious over Telfair et al. (US 6090102).

As for claims 2 and 3, Telfair discloses all that pertains to claim 1, and plural laser resonators are eye-safe fiber laser resonators. Telfair further discloses Er:YAG's allows for high degree of precision and control.... (1/31-37). Therefore it would be obvious to one of ordinary skill in the art to make the lasers out of Er:YAG to get high

degree of precision and control. Note Er:YAG is what the present application is using to enable "eye-safe wavelengths". ([0013] of instant application)

As for claim 13, Telfair discloses, an eye-safe laser system comprising: plural fiber laser resonators adapted to laser and means for combining beams output from said plural fiber laser resonators into a beam. Telfair further discloses, Er:YAG's allows for high degree of precision and control.... (1/31-37). Therefore it would be obvious to one of ordinary skill in the art to make the lasers out of Er:YAG to get high degree of precision and control.

As for claim 14, the laser system of claim 13 wherein said means for combining includes an external cavity (173 to 175)

As for claim 15, the laser system of claim 14 wherein said plural fiber laser resonators are coupled to plural pump sources 186.

As for claim 46 Telfair discloses, in fig 5, An eye-safe laser system comprising: plural Er:YAG fiber laser resonators 188; plural diode pump sources coupled to said plural Er:YAG fiber laser resonators 186 to pump said plural Er:YAG fiber laser resonators; and a phase locker (between 173 and 175) coupled to said plural Er:YAG fiber laser resonators and adapted to phase lock outputs of said fiber laser resonators to produce a single collimated combined laser beam 250 as output in response thereto. Telfair further discloses Er:YAG's allows for high degree of precision and control.... (1/31-37). Therefore it would be obvious to one of ordinary skill in the art to make the lasers out of Er:YAG to get high degree of precision and control.

As for claim 57, a method for generating an eye-safe laser beam comprising the steps of: obtaining plural fiber laser resonators 188 adapted to lase at eye-safe wavelengths and combining beams output from said plural fiber laser resonators into a single L3 eye-safe laser beam via a cavity (173 to 175) external to said fiber laser resonators. Telfair further discloses Er:YAG's allows for high degree of precision and control.... (1/31-37). Therefore it would be obvious to one of ordinary skill in the art to make the lasers out of Er:YAG to get high degree of precision and control.

11. Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over, Telfair et al. (US 6090102) as applied to claim 15 above (see bullet 10), and further in view of Leonberger et al. (US 5317576).

As for claims 16 and 17, Telfair discloses all that pertains to claim 15 above. However they do not explicitly disclose having integrated Bragg grating mirrors. Leonberger discloses, "there is a pronounced need for laser sources that can be continuously tuned and/or chirped. To achieve this, it was proposed to use intracore Bragg gratings as end reflectors delimiting the laser cavity in the optical waveguide"(1/35-39) Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use integrated Bragg grating reflectors to tune the laser source.

12. Claims 18 and 19 rejected under 35 U.S.C. 103(a) as being unpatentable over, Telfair et al. (US 6090102) as applied to claim 15 above (under bullet 10), and further in view of Cloonan et al. (US 5258978).

As for claims 18 and 19, Telfair discloses all that pertains to claim 15. Telfair further disclose a partially transmissive feedback mirror (175). However Telfair does not explicitly disclose a spatial filter with beam flattening optics next to it. Cloonan Discloses," A large uniform spot array is achieved by abutting many uniform copies of a small uniform spot array."(46/5-7) Cloonan further discloses, "The unwanted, non-uniform spots are blocked out by spatial filter 305. "(45/65-66) Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to make multiple flattop beams to have a uniform larger beam. It would have also been obvious to one of ordinary skill in the art to use a spatial filter to further make the beam more uniform.

13. Claims 20-22, 24, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Telfair et al. (US 6090102) and Cloonan et al. (US 5258978) as applied to claim 19 (see bullet 12) above, and further in view of Brauch et al. (US 5862278).

As for claim 20 Telfair and Cloonan disclose all that pertains to claim 19. However neither Telfair nor Cloonan explicitly disclose the geometry of the beam-flattening optics. Brauch discloses, "optimally close arrangement of the single optical elements is then achieved by the single optical elements being oriented in an extremely dense, hexagonal form." (4/35-38). Therefore it would have been obvious to one of

ordinary skill in the art at the time of the invention to orient the optics in a hexagonal pattern to have a dense form.

As for claim 21, Telfair discloses, said plural pump sources include diodes (15/18-19).

As for claim 22, see rejections of claim 13.

As for claim 24, Telfair discloses, plural pump sources include a diode emitter array for each of said plural fiber laser resonators (15/18-19).

As for claim 26, Telfair discloses, a clad end-pumping configuration for coupling each diode emitter array 186 to a corresponding fiber laser resonator. The fibers are pumped from the end as shown.

14. Claims 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Telfair et al. (US 6090102) and Cloonan et al. (US 5258978) and Brauch et al. (US 5862278) as applied to claims 24 (see bullet 13) above and in further View of Spariosu ("Intracavity 1.549- μm Pumped 1.634- μm Er:YAG Lasers at 300 K").

Telfair, Cloonan, Brauch disclose all that pertains to claim 24; however neither Telfair Cloonan nor Brauch disclose the wavelength used to pump the Er:YAG. Spariosu discloses "the 0.5% Er:YAG 1-cm-long crystal lased with the highest efficiency when pumped outside cavity by the 1.532-μm Er:Glass laser" (page 1047, Column 1 Paragraph 2). Therefore it would have been obvious to one of ordinary skill in the art to pump the resonators with a 1.532 μm to get the highest efficiency.

15. Claims 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Telfair et al. (US 6090102) and Cloonan et al. (US 5258978) and Brauch et al. (US 5862278) as applied to claims 26 above (see bullet 13) and in further view of Wolak et al. (US 2002/0159489).

As for claim 27, Telfair, Cloonan and Brauch disclose all that pertains to claim 26. However Telfair does not explicitly disclose using discrete imaging optics (i.e. Lenses) to couple the laser diodes to the resonators. Wolak discloses, "top view of another lens 62 on a fiber end that provides high coupling efficiency and low feedback when used to couple light from a laser diode". Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use lenses to have a high coupling efficiency.

16. Claims 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Telfair et al. (US 6090102) and Cloonan et al. (US 5258978) and Brauch et al. (US 5862278) as applied to claims 24 (see bullet 13) above in further view of Gordon (US 4786132).

As for claim 25, Telfair, Cloonan and Brauch disclose all that pertains to claim 24, however they do not explicitly disclose a light pipe. Gordon (US 4786132) discloses, "the laser diode fiber pigtail combination does not appear to be subject to mechanical instabilities "(6/63-64). Therefore it would be obvious to one of ordinary skill in the art use a pigtail to eliminate instabilities. A pigtail is a type of light pipe.

17. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Telfair et al. (US 6090102) in view of Cloonan et al. (US 5258978).

Telfair discloses, A beam phase-locking system comprising: first means for receiving plural single-mode beams 186 of electromagnetic energy and providing beams as output in response thereto and second means for combining said beams 180 and providing a collimated combined beam in response thereto 250.

However Telfair does not expressly disclose the beams have a flat top. Cloonan Discloses," A large uniform spot array is achieved by abutting many uniform copies of a small uniform spot array."(46/5-7) Cloonan further discloses, "The unwanted, non-uniform spots are blocked out by spatial filter 305. "(45/65-66) Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to make multiple flattop beams to have a uniform larger beam. It would have also been obvious to one of ordinary skill in the art to use a spatial filter to further make the beam more uniform.

18. Claims 30, 31, 37, 38, 41-44, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over, Telfair et al. (US 6090102), and Cloonan et al. (US 5258978) as applied to claim 29 above (see bullet 17), and further in view of Leonberger et al. (US 5317576).

As for claim 30, Telfair and Cloonan disclose all that pertains to claim 29 above. However they do not explicitly disclose having integrated Bragg grating mirrors.

Leonberger discloses, "there is a pronounced need for laser sources that can be continuously tuned and/or chirped. To achieve this, it was proposed to use intracore Bragg gratings as end reflectors delimiting the laser cavity in the optical waveguide"(1/35-39) Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use Bragg grating reflectors to tune the laser source.

As for claim 41 and 42 the spatial filter suggested by Cloonan is a pair of collimating lenses (304 and 306) with an aperture at the focal point (305).

As for 31, Telfair discloses using Er-doped YAG crystal (Er:YAG) resonator cores (1/31-37).

As for 37, Telfair discloses means for pumping said fiber laser oscillators. The oscillators need to be pumped to function.

As for 38, means for pumping includes plural diode emitters (15/18-19).

As for claim 43, Telfair discloses a partially transmissive feedback mirror 175.

As for claim 44, because the grating is integrated it would have to be in front of the beam flattening optics; the collimated lens suggested by Cloonan is after the beam flattening optics. Therefore the limitations of the claim are met.

As for claim 47, Telfair discloses Telfair further discloses Er:YAG's allows for high degree of precision and control.... (1/31-37).

19. Claims 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over, Telfair et al. (US 6090102), and Cloonan et al. (US 5258978) and Leonberger et al. (US

5317576) as applied to claim 31 above (see bullet **18**) and in further view of Spariosu ("Intracavity 1.549- μm Pumped 1.634- μm Er:YAG Lasers at 300 K").

As for claim 36, Telfair, Cloonan and Leonberger disclose all that pertains to claim 37. However neither Telfair Cloonan nor Leonberger explicitly disclose the concentration of Er in the laser. Spariosu discloses, on page 1044, column 2 paragraph 4, "In our particular case, the shifted Er:glass wavelength of 1.549 pm (from the standard 1.532 μm) has an absorption coefficient in Er:YAG .... per one percent Er+3 concentration in YAG." Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to make the Er:YAG 0.5% or lower to get a better absorption coefficient.

20. Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over, Telfair et al. (US 6090102), and Cloonan et al. (US 5258978) and Leonberger et al. (US 5317576) as applied to claim 37 above (see bullet **18**) and in further view of Wolak et al. (US 2002/0159489).

As for claim 40, Telfair, Cloonan and Leonberger disclose all that pertains to claim 37. However neither Telfair Cloonan nor Leonberger explicitly disclose using discrete imaging optics (i.e. Lenses) to couple the laser diodes to the resonators. Wolak discloses, "top view of another lens 62 on a fiber end that provides high coupling efficiency and low feedback when used to couple light from a laser diode". Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use lenses to have a high coupling efficiency.

21. Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over, Telfair et al. (US 6090102), and Cloonan et al. (US 5258978) and Leonberger et al. (US 5317576) as applied to claim 38 (see bullet **18**) above and in further view of Gordon (US 4786132).

As for claims 39, Telfair, Cloonan, and Leonberger disclose all that pertains to claim 38; however they do not explicitly disclose using pigtails. Gordon (US 4786132) discloses, "the laser diode fiber pigtail combination does not appear to be subject to mechanical instabilities "(6/63-64). Therefore it would be obvious to one of ordinary skill in the art use a pigtail to eliminate instabilities.

22. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kubota et al. (US 5202893) in view of Gordon (US 4786132).

As for claim 6 Kubota disclose all that pertains to claim 4 (shown using bullet 5.) However neither Kubota nor Komine explicitly disclose a pigtail. Gordon (US 4786132) discloses, "the laser diode fiber pigtail combination does not appear to be subject to mechanical instabilities "(6/63-64). Therefore it would be obvious to one of ordinary skill in the art use a pigtail to eliminate instabilities.

23. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kubota et al. (US 5202893) in view of Cloonan et al. (US 5258978).

As for claim 9, Kubota discloses all that pertains to claim 8 (shown using bullet 5.) Kubota further discloses an output-coupling mirror 6. However Kubota does not disclose beam flattening optics nor a spatial filter. Cloonan Discloses," A large uniform spot array is achieved by abutting many uniform copies of a small uniform spot array."(46/5-7) Cloonan further discloses, "The unwanted, non-uniform spots are blocked out by spatial filter 305. "(45/65-66) Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to make multiple flattop beams to have a uniform larger beam. It would have also been obvious to one of ordinary skill in the art to use a spatial filter to further make the beam more uniform.

24. Claims 13-15 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubota et al. (US 5202893) in view of Telfair et al. (US 6090102).

As for claim 13, Kubota discloses, A laser system comprising: plural fiber laser resonators 3 and means for combining beams output from said plural fiber laser resonators into a single laser beam 4-6. However Kubota does not disclose using an eye safe laser beam. Telfair discloses, Er:YAG's allows for high degree of precision and control.... (1/31-37). Therefore it would be obvious to one of ordinary skill in the art to make the lasers out of Er:YAG to get high degree of precision and control.

As for claim 14, Kubota discloses said means for combining includes an external cavity 5 and 6.

As for claim 15, Kubota discloses, said plural fiber laser resonators are coupled to plural pump sources 1.

As for claim 46 Kubota discloses, in fig 1, An eye-safe laser system comprising: plural diode pump sources 1 coupled to said plural fiber laser resonators 3 to pump said plural fiber laser resonators; and a phase locker (between 5 and 6) coupled to said plural fiber laser resonators and adapted to phase lock outputs of said fiber laser resonators to produce a single collimated combined laser beam L3 as output in response thereto. However Kubota does not disclose using an Er:YAG laser beam. Telfair discloses, Er:YAG's allows for high degree of precision and control.... (1/31-37). Therefore it would be obvious to one of ordinary skill in the art to make the lasers out of Er:YAG to get high degree of precision and control.

25. Claims 18 and 19 rejected under 35 U.S.C. 103(a) as being unpatentable over, Kubota et al. (US 5202893) and Telfair et al. (US 6090102) as applied to claim 15 above (under bullet **24**), and further in view of Cloonan et al. (US 5258978).

As for claims 18 and 19, Kubota and Telfair disclose all that pertains to claim 15. Kubota and Telfair further disclose a partially transmissive feedback mirror (6 Kubota; 175 Telfair). However neither Kubota nor Telfair disclose a spatial filter with beam flattening optics next to it. Cloonan Discloses," A large uniform spot array is achieved by abutting many uniform copies of a small uniform spot array."(46/5-7) Cloonan further discloses, "The unwanted, non-uniform spots are blocked out by spatial filter 305. "(45/65-66) Therefore it would have been obvious to one of ordinary skill in the art at the

time of the invention to make multiple flattop beams to have a uniform larger beam. It would have also been obvious to one of ordinary skill in the art to use a spatial filter to further make the beam more uniform.

26. Claims 20-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Telfair et al. (US 6090102) and Kubota et al. (US 5202893) and Cloonan et al. (US 5258978) as applied to claim 19 (see bullet **25**) above, and further in view of Brauch et al. (US 5862278).

As for claim 20 Kubota, Telfair and Cloonan disclose all that pertains to claim 19. However Telfair, Cloonan, nor Kubota explicitly disclose the geometry of the beam-flattening optics. Brauch discloses, "optimally close arrangement of the single optical elements is then achieved by the single optical elements being oriented in an extremely dense, hexagonal form." (4/35-38). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to orient the optics in a hexagonal pattern to have a dense form.

As for claim 21, Kubota discloses, said plural pump sources include diodes (1/30-31).

As for claim 22, see rejections of claim 13.

As for claim 23, Kubota discloses, laser resonators include resonator cores that are sufficiently different in length to facilitate longitudinal mode overlap among beams traveling along different resonator cores. As shown the left most and right most fibers are approximately equal and therefore reads on the claim.

27. Claims 29, 52-54 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubota et al. (US 5202893) in view of Cloonan et al. (US 5258978).

Kubota discloses, A beam phase-locking system comprising: first means for receiving plural single-mode beams 1 of electromagnetic energy and providing beams as output in response thereto and second means for combining said beams (4, 5, or 6) and providing a collimated combined beam in response thereto L3.

However Kubota does not expressly disclose the beams have a flat top. Cloonan Discloses," A large uniform spot array is achieved by abutting many uniform copies of a small uniform spot array."(46/5-7) Cloonan further discloses, "The unwanted, non-uniform spots are blocked out by spatial filter 305. "(45/65-66) Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to make multiple flattop beams to have a uniform larger beam. It would have also been obvious to one of ordinary skill in the art to use a spatial filter to further make the beam more uniform.

As for claim 52, Kubota discloses in figure 1, an efficient multicore fiber laser comprising: plural pump sources 1 that provide input electromagnetic energy; laser resonator cores 2 coupled to said plural pump sources 1 and arranged to receive said input electromagnetic energy and provide laser energy in response thereto, said laser energy traveling within said laser resonator cores 2; and combining plural beams output from said plural resonator cores into a single coherent output beam L3. However

Kubota does not explicitly disclose a spatial filter. Cloonan further discloses, "The unwanted, non-uniform spots are blocked out by spatial filter 305. "(45/65-66) It would have been obvious to one of ordinary skill in the art to use a spatial filter to further make the beam more uniform.

As for claim 53, Kubota discloses, said laser resonator cores are optically side coupled, edge coupled, fusion coupled, and/or prism coupled to said plural pump sources. The resonators are couple to the front side of figure 1, Therefore all the limitations of the claim are met.

As for claim 54 and 56, further including a container (shaded area of fig. 2, 2) accommodating said resonator cores, said container internally reflecting said input electromagnetic energy (if the container did not reflect the energy then the Kubota's figure would be non-enabled, especially around the turn in fig1.) to facilitate (intended use) coupling of said input electromagnetic energy with said laser resonator cores. Therefore all the limitations of claim 54 are met. Note: fig 2 is a cross-section of part of fig 1 (2/30-35). The cross section of the container is round, Shown in fig 2 and has a length as shown in fig 1. This shape is a cylinder. Therefore the limitations of claim 56 are met.

28. Claims 30, 41, and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over, Kubota et al. (US 5202893) and Cloonan et al. (US 5258978) as

applied to claim 29 above (see bullet **27**), and further in view of Leonberger et al. (US 5317576).

As for claim 30 Kubota, Telfair and Cloonan discloses all that pertains to claim 29 above. However they do not explicitly disclose having integrated Bragg grating mirrors. Leonberger discloses, "there is a pronounced need for laser sources that can be continuously tuned and/or chirped. To achieve this, it was proposed to use intracore Bragg gratings as end reflectors delimiting the laser cavity in the optical waveguide"(1/35-39) Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use Bragg grating reflectors to tune the laser source.

As for claim 41 and 42 the spatial filter suggested by Cloonan is a pair of collimating lenses (304 and 306) with an aperture at the focal point (305).

29. Claims 31-33, 43, 44, 47 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over, Kubota et al. (US 5202893) and Cloonan et al. (US 5258978) and Leonberger et al. (US 5317576) as applied to claim 30, and 42 above (see bullet 28) and in further view of Telfair et al. (US 6090102).

As for claim 31, Kubota, Leonburger, and Cloonan disclose all that pertains to claim 30. However neither Kubota, Leonburger, nor Cloonan disclose using an Er:YAG laser. Telfair discloses, Er:YAG's allows for high degree of precision and control.... (1/31-37). Therefore it would be obvious to one of ordinary skill in the art to make the lasers out of Er:YAG to get high degree of precision and control.

As for claim 32, Kubota discloses in Fig. 2 (2/32-37), the fiber laser resonators include dielectric cladding at least partially surrounding said resonator cores. The cladding is the shaded area around the cores of figure 2

As for claim 33, Kubota discloses in Fig 1, fiber laser resonators are approximately equivalent lengths or differ in length by more than 1.4 centimeters. As shown the left most and right most fibers are approximately equal and therefore reads on the claim.

As for claim 43, Kubota discloses a partially transmissive feedback mirror 6.

As for claim 44, because the grating is integrated it would have to be in front of the beam flattening optics; the collimated lens suggested by Cloonan is after the beam flattening optics. Therefore the limitations of the claim are met.

As for claim 47, see claim 31 above.

As for claim 48, Kubota discloses, fiber laser resonators are approximately equivalent lengths or differ in length by more than 1.4 centimeters. As shown the left most and right most fibers are approximately equal and therefore reads on the claim.

30. Claim 45 and 49-51 is rejected under 35 U.S.C. 103(a) as being unpatentable over, Kubota et al. (US 5202893) and Telfair et al. (US 6090102), and Cloonan et al. (US 5258978) and Leonberger et al. (US 5317576) as applied to claims 44 and 48 above (see bullet **29**), and further in view of Brauch et al. (US 5862278).

As for claims 45 and 49, Kubota, Telfair, Cloonan, and Leonberger disclose all that pertains to claim 44 and 48; however they do not explicitly disclose the geometry of

the beam-flattening optics. Brauch discloses, "optimally close arrangement of the single optical elements is then achieved by the single optical elements being oriented in an extremely dense, hexagonal form." (4/35-38). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to orient the optics in a hexagonal pattern to have a dense form.

As for claim 50, the spatial filter attenuates these higher order modes, as the combined beam oscillates between the feedback mirror and integral reflectors in the fibers. Therefore the limitations of the claim are met.

As for claim 51, all mirrors are at least partially reflective and as such mirror 6 would reflect part of the light back through the spatial filter (as described above) and if mirror 6 of Kubota would have to transmit part of the light or it would be non-enabled. Therefore the limitations of the claim are met.

31. Claims 52, 53, 54, and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubota et al. (US 5202893) in view of Cloonan et al. (US 5258978).

32. Claims 54-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubota et al. (US 5202893) and Cloonan et al. (US 5258978) as applied to claim 53 above (see bullet 27) and in further view of Ueda et al. ("**1kW CW output from fiber-embedded disk lasers**"; Lasers and Electro-Optics, 2002. CLEO '02. Technical Digest. Summaries of Papers Presented at the 2002 Page(s):CPDC4-1 - CPDC4-2 vol.2 Digital Object Identifier 10.1109/CLEO.2002.1034492.)

As for claim 54 and 55 Kubota and Cloonan disclose all that pertains to claim 53. However they do not disclose using a substantially flat disk or plate designed for total internal reflection of laser energy, accommodating said resonator cores. Ueda discloses, "In a case of circulation pumping we inject the laser diode power from the ribbon fibers fabricated to the fiber disk active area as shown in Fig.2. In this scheme the whole pumping power should be absorbed in the core area without big loss because the pumping power is confined in the fiber disk" (Page 1 Paragraph 2). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a disk container with multiple pump sources *so that the whole pumping power can be absorbed in the core area without big loss.*

Conclusion

33. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hughes (US 5276758) discloses a hexagonal optics array.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey D. Lane whose telephone number is (571) 272-1676. The examiner can normally be reached on Monday thru Friday 8:30 to 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571) 272-1835. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jeffrey D Lane
Examiner
Art Unit 2828

JDL

MINSUN HARVEY
PRIMARY EXAMINER